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EXAMINER

CULBERT, ROBERTS P

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 04/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/017,494	Applicant(s) BASOL ET AL.	
	Examiner Roberts Culbert	Art Unit 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 34-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 34-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 2/24/04 have been fully considered but they are not persuasive.

Applicant has argued, *"The recitation of independent claim 34 is neither taught nor suggested either alone or in combination"*. In support of this argument, applicant states, *"Lee et al. is concerned with detecting the thickness of a previously deposited metal layer during CMP, which is a material removal technique. In contrast, the present invention is concerned with detecting the degree of planarization of the material being deposited."*

The argument is not persuasive because the combination of Lee with the admitted prior art teaches all of the limitations of independent claim 34. Lee is not relied upon to teach the planarization method. Lee is relied upon to teach the detection method, which as one of ordinary skill in the art would recognize, is suitable for detecting a planarization process in the presence of a workpiece surface influencing device even if the process uses only a minimal amount of CMP.

Applicant has argued, *"the admitted prior art is not properly combinable with Lee et al. reference because the admitted prior art teaches away or at least minimizes the use of CMP processing."*

The argument is not persuasive because the admitted prior art does not, in any regard, teach away from the use of CMP. In fact, as one of ordinary skill in the art would recognize, the prior art technique almost certainly requires the use of some CMP processing. The fact that the prior art method minimizes the amount of CMP processing does not teach away from CMP use or CMP detection methods.

Applicant has argued, *"Even in light of the forced combination of the prior art with Lee et al, there is no suggestion that would lead an artisan in the art to combine the teachings. The present invention is concerned with deposition and planarization of deposited material during the deposition. Lee et al. on the other hand is concerned with copper removal and detection of the copper removal process."*

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The argument is not persuasive because it would have been obvious to one of ordinary skill in the art at the time of invention to use the detection method of Lee to detect planarization of the surface being planarized in the prior art method since Lee teaches that the disclosed optical detection method is suitable for determining planarization of a conductive (copper) layer deposited on a substrate in the presence of a work-piece surface-influencing device. The fact that the admitted prior art technique uses deposition and removal with CMP to planarize the surface, and the method of Lee et al. suggests only removal with CMP to planarize the surface would not be sufficient to lead one of ordinary skill away from using the detection method of Lee et al. with the admitted prior art technique. In both the admitted prior art and Lee et al., a conductive surface is planarized in the presence of a work-piece surface-influencing device in a similar manner. This similarity would be entirely sufficient for one of ordinary skill in the art to make the cited combination.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors.

In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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Claims 34-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of U.S Patent 6,179,691 to Lee et al.

The admitted prior art teaches an electrochemical mechanical deposition process that uses a solution containing a conductor therein and operates upon a work-piece top surface comprising the steps of: depositing the conductor to fill features within the top surface of the work-piece using electrochemical mechanical deposition employing a work-piece surface influencing device, an applied potential and the solution;

Regarding claim 51, the admitted prior art also teaches that the top surface may be a conductive or insulator surface and that the step of operating deposits a conductor into the features disposed in the top surface of the work-piece.

The admitted prior art does not teach a method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light onto the top surface of the work-piece to obtain a reflected beam of light, a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece; and detecting a change in the characteristic of the reflected beam of light indicative of a degree of planarization of the top surface of the work-piece.

Referring to figure 1 and the disclosure (Col. 3, Line 54-67), Lee et al. teaches a prior art method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light (24) onto the top surface of the work-piece to obtain a reflected beam of light (26), a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece (Col. 4, Lines 10-13); and detecting a change in the characteristic of the reflected beam of light indicative of a change in the degree of planarization of the work-piece (Col. 3, Line 67, and Col. 4, Lines 7-10).

Regarding claim 52 the signal obtained in the detection method of Lee contains information indicative of a degree of planarity of the top conductive layer, since Lee measures the intensity of reflected light.

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Regarding claim 53, Lee teaches detecting a characteristic of the reflected beam of light (intensity) and detecting (measuring) the characteristic of the reflected beam of light indicative of a change in degree of planarization of the work-piece and transforming the characteristic (intensity) into a signal (termination of the planarizing process), which corresponds to the degree of planarity of the top surface.

It would have been obvious to one of ordinary skill in the art at the time of invention to use the detection method of Lee to detect planarization of the surface being planarized in the method of the instant application since Lee teaches that the disclosed optical detection method is suitable for determining planarization of a conductive (copper) layer deposited on a substrate employing a work-piece surface influencing device.

Regarding claim 35, 46, and 54, Lee teaches that it is conventional to terminate the planarizing process when the intensity of the light beam reaches a certain level (Col. 4, Lines 4-7). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention that the step of detecting a change further include the step of providing an indicator to halt the step of depositing when the top surface pattern of the work-piece reaches a predetermined degree of planarization, thus indicating the filling of the features with the conductor. One of ordinary skill in the art would have been motivated at the time of invention to halt the planarizing process as soon as the predetermined degree of planarization is achieved in order to reduce processing time.

Regarding claims 40, 42, 44 and 58 Lee teaches that the intensity of the reflected light is monitored (Col. 3, Lines 65-67)

Regarding claims 41 and 43 Lee teaches that the beam of light transmitted onto the top surface of the work-piece passes through the work-piece surface-influencing device.

Regarding claims 36-38, 47-50, 55-57, and 65, the admitted prior art teaches that it is conventional to form very thin planar deposits by first depositing a planar layer using an ECMD technique and then using an ECME technique on the planar film in the same electrolyte (within a same processing area) by reversing the applied voltage.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to provide a material removal step of chemical mechanical processing such as ECME.

Furthermore, since Lee et al. teaches a method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light onto the top surface of the work-piece to obtain a reflected beam of light, a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece; and detecting a change in the characteristic of the reflected beam of light indicative of a degree of planarization of the work-piece, it would have been obvious to one of ordinary skill in the art at the time of invention to use the detection method of Lee to detect planarization of the surface being planarized in the method of the instant application since Lee teaches that the disclosed optical detection method is suitable for determining planarization of a conductive (copper) layer deposited on a substrate in the presence of a work-piece surface influencing device.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to transmit another beam of light onto the top surface of the work-piece to obtain another reflected beam of light; and detect another change in a characteristic of the other reflected beam of light indicative of another material forming a new top surface of the work-piece as taught by Lee. One of ordinary skill in the art would have been motivated at the time of invention to use the detection method of Lee to monitor the planarization method of the instant application as Lee teaches that the disclosed optical detection method is suitable for the intended purpose as stated. Note that the admitted prior art teaches that it is conventional to remove all of the conductive material from the field regions and thus another material is on the top surface. This feature is also illustrated in Figs. 3 and 7 of Lee et al. for example.

Regarding Claims 59, 63 and 64, Lee et al teaches that the intensity of light decreases as the thickness of the copper layer is reduced. In the process of the admitted prior art the thickness of the copper layer is increased and so the intensity of the light would be increased as the surface is planarized.

Regarding Claim 39, It would have been obvious to one of ordinary skill in the art at the time of invention to use the same source for the beam of light and the another beam of light in order to reduce the amount of equipment and expense needed for processing since the same source is capable of

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transmitting the beam of light and the another beam of light is transmitted after the beam of light is transmitted.

Regarding Claims 60 and 61, both the admitted prior art and the disclosure of Lee et al. teach that the conductor is copper.

Regarding Claim 62, the admitted prior art and Lee et al. teach that it is conventional to form a barrier layer before depositing the copper layer. The barrier layer forms the top surface of the workpiece as the copper is removed from the top surface. Therefore the step of detecting the change in a characteristic of the another beam of light would be indicative of the barrier layer on a top surface of the workpiece.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (7:30-4:00):

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

R. Culbert




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